# ATTACHMENT 6. LANDSCAPE-SCALE MITIGATION

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## INTRODUCTION

The Final Environmental Impact Statement (FEIS) for the Continental Divide-Creston Natural Gas Development Project (CD-C) analyzes the effects of developing up to 8,950 additional natural gas wells and ancillary facilities within the 1.1 million-acre project area. This attachment identifies opportunities to apply landscape-scale mitigation in order to address reasonably foreseeable impacts, identified in the CD-C FEIS, that may occur as a result of this development. This attachment summarizes impacted resources, the mitigation measures identified in the FEIS (either in Chapter 4 or Appendix C of the FEIS, or Attachment 2 of this ROD) to address those impacts, and the remaining reasonably foreseeable residual impacts[1]. Finally, this attachment identifies those residual impacts that may warrant compensatory mitigation, and outlines the process, criteria, and examples that might be used to address unacceptable residual impacts and how to determine the appropriate amount of compensatory mitigation for those impacts.

The Council on Environmental Quality (CEQ) has defined mitigation (i.e. the mitigation hierarchy) in its regulations at 40 CFR 1508.20 as:

- Avoiding the impacts by not taking a certain action or parts of an action;
  - e.g. establishing a No Surface Occupancy lease stipulation or setback from a sensitive resource.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
  - e.g. painting facilities an appropriate color or co-location of infrastructure.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
  - e.g. performing stream restoration following installation of a pipeline that impacted the stream's stability.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;
  - e.g. completing interim reclamation on a natural gas facility.
- Compensating for the impact by replacing or providing substitute resources or environments;
  - e.g. removing existing infrastructure in one location along a Wild and Scenic River when impacted in another location.

The BLM implements the mitigation hierarchy by first, seeking to avoid the impact via altering project design, location, or timing; then the BLM seeks minimization of the impacts through, for example, project modifications, permit conditions, interim and final reclamation, etc. Only if those approaches are insufficient to mitigate residual impacts to an acceptable level, will the BLM explore the use of compensatory mitigation. All mitigation measures implemented, including potential compensatory mitigation, will be subject to valid existing rights and be consistent with lease rights granted. Any credits offered for compensatory mitigation shall provide required features which include: occupancy, durability, additionality, risk reduction, landscape support, habitat suitability, disturbance limits, and financial assurances.

[1] Residual impacts are any adverse reasonably foreseeable effects that are expected to remain after consideration and application of the first four aspects in the mitigation hierarchy described above.

This attachment will function as a mitigation strategy for the CD-C Project Area. For future actions that tier to the CD-C FEIS, this attachment outlines how the BLM will include avoidance, minimization, rectification, reduction/elimination, and (for those resources that were determined to have residual impacts that warrant compensatory mitigation) compensatory mitigation FEIS. Future actions that tier to the CD-C FEIS will have site-specific NEPA analysis completed that will identify the necessary mitigation measures, in accordance with this attachment. During site-specific analysis of actions (i.e. APDs, ROWs, or ancillary facilities) that tier to the CD-C FEIS, the BLM will identify appropriate mitigation, including avoidance and minimization measures. The site-specific NEPA analysis will also identify residual impacts that may remain following application of avoidance and minimization measures, and if any residual impacts warrant compensatory mitigation.

The Rawlins RMP and the CD-C FEIS identify areas of avoidance as well as minimization measures that would be implemented to minimize impacts to these resources, in an effort to reduce the potential for unacceptable residual impacts. The CD-C FEIS has identified that residual impacts may occur to mule deer and pronghorn crucial winter range, as well as Greater Sage-Grouse. Depending on the site-specific proposals received by Operators, the BLM may make a final determination that compensatory mitigation is warranted based on the extent of the impacts and whether the residual impacts that occur at that site-specific level are unacceptable. During analysis of actions that tier to the CD-C FEIS, the BLM will identify, analyze and explore compensatory mitigation to address the reasonably foreseeable impacts to these resources that remain and/or when certain circumstances (e.g. valid existing rights, lack of technologic capabilities) make it impossible to avoid or minimize the impacts to these species' habitats and, therefore, require replacement or substitute resources or environments for these species. The need for compensatory mitigation will be based on applicable mitigation standards and what is appropriate and commensurate with the reasonably foreseeable residual effects. In order to determine if compensatory mitigation is warranted, the BLM will consider the extent to which residual effects should be mitigated in order to comply with applicable law, policy, or RMP objectives , or to protect resources that are considered important, scarce, or sensitive and were identified as warranting compensatory mitigation through a NEPA analysis or mitigation strategy. The extent of residual impacts that may occur as a result of actions that tier to the CD-C FEIS is unknown at this time, due to the programmatic nature of the CD-C FEIS.

If, in a site-specific NEPA document and/or other APD-level analysis, unacceptable residual impacts to pronghorn antelope or mule deer crucial winter range, or Greater Sage-Grouse habitat, are identified that would occur on BLM-managed lands, the BLM will:

1. Describe the residual effects.
2. Calculate the compensatory mitigation obligation associated with the residual effects.
    a. Determine the base amount of compensatory mitigation (debits). (Section F.2 of this Appendix)
    b. Adjust the amount of compensatory mitigation (debits) with consideration to risk or other relevant factors as determined by the authorized officer.
    c. Describe the potential type of compensatory mitigation appropriate for mitigating the residual impacts, including each of the mitigation measures and their required outcome.
    d. Determine the site(s) of the compensatory mitigation measures or analyze the proponent-proposed mitigation so as to provide for the appropriate types and amount of compensatory mitigation measures (commensurate with the debit), and achieve the maximum benefit toward the mitigation standard to the impacted resources within the context or the conditions and trends of those resources, at all relevant scales.

i. Additional adjustments to the amount of compensatory mitigation may be necessary to account for issues related to the compensatory mitigation measures and sites, such as differences between the quality of resources at the impacted site and those expected to be produced at the compensatory mitigation site, any lack of timeliness, the degree of durability of the compensatory mitigation site, and the type of compensatory mitigation.

e. If NEPA analysis has not already been completed, analyze the compensatory mitigation measures, sites and mechanisms necessary to meet the compensatory mitigation obligation, including length of durability and monitoring and reporting requirements.

f. Determine the compensatory mitigation mechanism(s). The BLM should discuss the compensatory mitigation mechanism options (choosing from the list of potential compensatory mitigation projects identified in the process described in **Section G** of this Appendix) with the land use authorization's applicant. The BLM will determine the mechanism(s), taking into account the preferences of the applicant.

g. Identify the required outcomes and responsible parties for each mitigation measure, site, and/or mechanism. The BLM may need to ensure that the proponent provides the BLM with an adequate performance bond or similar financial instrument. The BLM will include any costs for implementation and effectiveness monitoring and other applicable administration of the chosen mitigation measures.

3. In the decision document, the BLM will approve, deny, or approve with the additional mitigation the proposed land use activity.

   a. If approving the land use activity, the BLM will clearly identify in the decision document(s) the required mitigation measures (i.e. mitigation obligation) with the rationale from and reference to the associated NEPA analysis.

   b. The BLM must incorporate any mitigation obligations from the decision document(s) into the land use authorization via stipulations, terms and conditions, conditions of approval, etc., so that they become requirements of the land use authorization.

Only actions that would occur on BLM-managed lands would trigger the need for site-specific environmental analysis. The BLM has no authority to require compensatory mitigation for impacts to non-federal surface when there is no federal nexus.

This approach is consistent the BLM's statutory obligations and with Presidential, Departmental, and BLM policy.

## A. Affected Resources

The CD-C project and other land use activities expected in the geographic area are described in Chapters 3 and 5 of the CD-C FEIS. The resources listed below are those that were determined through the EIS process to be reasonably foreseeably impacted by development within the project area:

- **Physical Environment:** Geology, Paleontologic Resources, Soils, Water Resources, and Air Quality.
- **Biological Environment:** Vegetation, Invasive, Non-native Plant Species, Wildlife, Special Status Species, and Wild Horses.
- **Human Environment:** Visual Resources, Recreation, Lands with Wilderness Characteristics, Cultural and Historical Resources, Socioeconomics, Transportation and Access, and Noise.
- **Management Environment:** Range Resources, Oil and Gas and other Minerals, Health and Safety, and Waste and Hazardous Materials Management.

## B. Management Goals and Objectives

A description of the relevant management goals and objectives for these resources, at all relevant scales, is provided in the following locations of the Rawlins RMP:

- **Physical Environment**
  - Geology: RMP Section 2.3.16 Water Quality, Watershed, and Soils Management
  - Paleontologic Resources: RMP Section 2.3.9 Paleontology
  - Soils: RMP Section 2.3.16 Water Quality, Watershed, and Soils Management
  - Water Resources: RMP Section 2.3.16 Water Quality, Watershed, and Soils Management
  - Air Quality: RMP Section 2.3.1 Air Quality
- **Biological Environment**
  - Vegetation: RMP Section 2.3.14 Vegetation
  - Invasive Non-native Plant Species: RMP Section 2.3.14 Vegetation
  - Wildlife: RMP Section 2.3.18 Wildlife and Fisheries
  - Special Status Species: RMP Sections 2.3.14 Vegetation; 2.3.18 Wildlife and Fisheries
  - Wild Horses: RMP Section 2.3.17 Wild Horses
- **Human Environment**
  - Visual Resources: RMP FEIS No Action Alternative, Visual Resource Management
  - Recreation: RMP Sections 2.3.8 Off-Highway Vehicles; 2.3.10 Recreation and Visitor Services
  - Lands with Wilderness Characteristics: BLM Manual Sections 6310 and 6320
  - Cultural and Historical Resources: RMP Section 2.3.2 Cultural Resources
  - Socioeconomics: RMP Sections 2.3.11 Socioeconomics
  - Transportation and Access: RMP Sections 2.3.13 Transportation and Access Management; 2.3.8 Off-Highway Vehicles
  - Noise: Rawlins RMP APPENDIX 15 - Best Management Practices For Reducing Surface Disturbance And Disruptive Activities
- **Management Environment**
  - Range Resources: RMP Section 2.3.6 Livestock Grazing,
  - Oil and Gas and other Minerals: RMP Section 2.3.7 Minerals
  - Health and Safety: RMP Sections 2.3.8 Off-Highway Vehicles; 2.3.7 Minerals
  - Waste and Hazardous Materials Management: RMP Section 2.3.7 Minerals

## C. Baseline Conditions and Trends

A description of baseline conditions and trends (including consideration of change agents) of these resources, at all relevant scales, including how the conditions and trends are expected to change due to the reasonably foreseeable impacts is provided within this FEIS in the following locations:

- **Physical Environment**
  - Geology: CD-C FEIS Sections 3.1 and 4.1
  - Paleontologic Resources: CD-C FEIS Sections 3.2 and 4.2
  - Soils: CD-C FEIS Sections 3.3 and 4.3
  - Water Resources: CD-C FEIS Sections 3.4 and 4.4
  - Air Quality: CD-C FEIS Sections 3.5 and 4.5

- **Biological Environment**
  - Vegetation: CD-C FEIS Sections 3.6 and 4.6
  - Invasive, Non-native Plant Species: CD-C FEIS Sections 3.7 and 4.7
  - Wildlife: CD-C FEIS Sections 3.8 and 4.8
  - Special Status Species: CD-C FEIS Sections 3.9 and 4.9
  - Wild Horses: CD-C FEIS Sections 3.10 and 4.10
- **Human Environment**
  - Visual Resources: CD-C FEIS Sections 3.11 and 4.11
  - Recreation: CD-C FEIS Sections 3.12 and 4.12
  - Lands with Wilderness Characteristics: CD-C FEIS Sections 3.13 and 4.13
  - Cultural and Historical Resources: CD-C FEIS Sections 3.14 and 4.14
  - Socioeconomics: CD-C FEIS Sections 3.15 and 4.15
  - Transportation and Access: CD-C FEIS Sections 3.16 and 4.16
  - Noise: CD-C FEIS Sections 3.17 and 4.17
- **Management Environment**
  - Range Resources: CD-C FEIS Sections 3.18 and 4.18
  - Oil and Gas and other Minerals: CD-C FEIS Sections 3.19 and 4.19
  - Health and Safety: CD-C FEIS Sections 3.20 and 4.20
  - Waste and Hazardous Materials Management: CD-C FEIS Sections 3.21 and 4.21

## D. Mitigation Measures

Avoidance and minimization measures for impacts to resources within the CD-C project area are described in Attachment 2 of this ROD. These include mitigation measures from the Rawlins RMP, those identified as a result of the CD-C FEIS analysis, and standard COAs, SOPs, BMPs, and terms and conditions applied, as applicable, on every APD, ROW grant, or other authorization. Additional site-specific mitigation measures may be developed, as applicable and consistent with valid existing rights, when site-specific development applications are received.

## E. Effects That Do Not Warrant Compensatory Mitigation

Application of avoidance and minimization measures identified in the Rawlins RMP and FEIS for the following resources would reduce the impacts to an acceptable level and would not warrant compensatory mitigation at this time:

- Air Quality, Section 4.5.9;
- Wildlife, Section 4.8.5 (with the exception of pronghorn and mule deer);
- Special Status Species, Section 4.9.5 (with the exception of Greater Sage-Grouse);
- Cultural and Historical Resources, Section 4.14.5;
- Socioeconomics, Section 4.15.6; and
- Range Resources, Section 4.18.5.

The residual impacts of site-specific actions will be analyzed to determine if avoidance and minimization measures are adequate to residual impacts to a level that does not require compensatory mitigation.

## F. Residual Effects Warranting Compensatory Mitigation

Residual effects that warrant compensatory mitigation are identified based on the following criteria:

- If the residual effects would inhibit achieving compliance with applicable laws and/or policies.
- If the residual effects would inhibit achievement of the applicable land use plan (RMP)'s resource objectives.
- If the residual effects were to occur to resources that are considered important, scarce, sensitive, or have a legal mandate that have been previously identified in a NEPA analysis mitigation strategy as warranting compensatory mitigation.

When site-specific applications for actions are received, the BLM will complete site-specific NEPA analysis and will, through that NEPA analysis, determine if residual impacts occur, whether those residual impacts are unacceptable indicating that compensatory mitigation is warranted, and calculate the debits that would be associated with those impacts

Application of existing mitigation measures (including avoidance and minimization) may not be sufficient to reduce the level of impacts to acceptable levels for the following resources:

- **Wildlife Habitat: Pronghorn Antelope and Mule Deer Crucial Winter Range**

  The FEIS identified that pronghorn and mule deer crucial winter range habitat would be adversely affected in both the short- and long-term (Section 4.8.3.7), as a result of surface disturbance related to construction of well sites and associated facilities within the CD-C project area. The quality and function of habitat would also be impacted due to long-term alterations in the vegetative composition, as well as disruptive activities associated with natural gas production. These impacts would be in addition to historical impacts from previous surface disturbance. Impacts to pronghorn and mule deer crucial winter range habitat would affect at least ten percent of the CD-C project area. The impact analysis for mule deer and pronghorn habitat in the FEIS for the Preferred Alternative indicates that development may occur that would result in residual effects that would warrant compensatory mitigation. The FEIS has identified that impacts would result in substantial disruption or irreplaceable loss of vital and high-value habitats as defined in the Wyoming Game and Fish Commission Mitigation Policy (WGFD 2016). This policy classifies big game crucial ranges as high value habitat and was used as the threshold for quantifying impacts to big game in the CD-C FEIS (Section 4.8.2). Because impacts were identified through a NEPA analysis as resulting in substantial disruption or irreplaceable loss of vital and high-value habitats, i.e. scarce and sensitive resources, compensatory mitigation may be warranted for residual impacts that occur in pronghorn and mule deer crucial winter range.

  Mitigation Standard

  The Rawlins RMP identifies two objectives for wildlife habitat:

  - Maintain, restore, or enhance wildlife habitat in coordination and consultation with other local, state, and federal agencies and consistent with other agency plans, policies, and agreements. A full range of mitigation options will be considered when developing mitigation for project-level activities for wildlife and Special Status Species habitats; and
  - Maintain, restore, or enhance habitat function in crucial winter range.

  In order to ensure that crucial winter range for pronghorn and mule deer is, at a minimum, maintained in the CD-C project area, the BLM will develop mitigation that provides a no net loss standard to crucial winter range by avoiding, minimizing, and compensating for unavoidable, residual impacts that may occur as a result of development of existing leases in actions that tier to the CD-C FEIS.

All proposed mitigation, including avoidance, minimization, and compensation, will be consistent with valid existing rights and lease rights granted.

- **Special Status Species: Greater Sage-Grouse**

  Greater Sage-Grouse priority habitat within the CD-C project area may be affected as a result of development within Priority Habitat Management Areas (PHMAs). The presence of valid existing rights within sage-grouse PHMA may result in exceedance of disturbance and/or facility density thresholds, which would result in residual impacts based on the management objectives established by the Greater Sage-Grouse RMP Amendment. The CD-C FEIS identifies that localized, unavoidable adverse impacts to Greater Sage-Grouse could occur at the site specific level in General Habitat Management Areas (GHMAs) and PHMAs where there are valid existing rights (Section 4.9.5). These impacts could warrant compensatory mitigation as they would likely inhibit the achievement of the RMP's resource objectives.

  Mitigation Standard

  The Rawlins RMP (and the Greater Sage-Grouse RMP amendment) identifies the following objectives for the management of Greater Sage-Grouse:

  - Maintain, restore, or enhance designated BLM State Sensitive Species habitat to prevent listing under the Endangered Species Act.
  - Maintain and enhance quality/suitable habitat to support the expansion of Sage-Grouse populations on federally-administered lands within the planning area.
  - Manage sage-grouse seasonal habitats and maintain habitat connectivity to support population objectives set by the State of Wyoming in cooperation with the agencies.
  - Protect PHMAs and GHMAs from anthropogenic disturbance that will reduce distribution or abundance of Greater Sage-Grouse.

  In order to achieve Greater Sage-Grouse habitat goals and objectives established in the Approved Resource Management Plan Amendments (ARMPA) for the Rocky Mountain Region and the Rawlins RMP in the CD-C project area, the BLM will require and evaluate mitigation that provides a net conservation gain for sage-grouse populations and habitat within PHMA and a no net loss to GHMA (please see the November 2015 Presidential Memorandum on Mitigation Impacts on Natural Resources from Development and Encouraging Related Private Investments; the November 2015 update to the Interior Department Manual outlining key principles and direction for implementing landscape mitigation; and Secretarial Order No. 3330) by avoiding, minimizing, and, where avoidance and minimization are either inadequate or impossible, compensating for unavoidable residual impacts.

  When necessary, offsite compensatory mitigation for Greater Sage-grouse will be applied consistent with Wyoming's Core Area Strategy (Wyoming ARMPA page 26). The BLM will require and ensure mitigation that provides a net conservation gain to the species. This will include accounting for any uncertainty associated with the effectiveness of such mitigation in PHMAs. Furthermore, the Wyoming ARMPA requires a net conservation gain for sage-grouse populations and habitats, consistent with the Wyoming Core Area Strategy (ARMPA page 20).

  All proposed mitigation, including avoidance, minimization, and compensation, will be consistent with valid existing rights and lease rights granted.

*Debit Calculation:*

The BLM should determine the amount of compensatory mitigation that is commensurate to the residual effects that warrant compensatory mitigation and that is consistent with any applicable mitigation

standard. The BLM should be transparent and provide a clear rationale for the amount of compensatory mitigation in the NEPA analysis and decision document(s). The following process should be used as a framework to determine the amount of compensatory mitigation:

1. Determine the magnitude of impacts to the resource by:
   a. Determining the baseline condition and trend of the resource at the impacted site; and
   b. The amount of change to the baseline condition and trend due to the residual effects from the public land use. This analysis should consider both direct and indirect impacts. The calculation of debits will be developed based on best available science and in consultation with the State of Wyoming for impacts to Greater Sage-grouse.
2. Determine the magnitude of the benefits needed to adhere to the mitigation standard. The BLM should compare the magnitude of the impacts to the resource to any applicable mitigation standard (i.e. no net loss). If no mitigation standard yet exists for the resource, the BLM should use this step in the process to consider the project-specific mitigation standard for the resource (through the decision document supported by appropriate NEPA analysis).
3. Determine the amount of compensatory mitigation needed to achieve the magnitude of benefits by:
   a. Determining the baseline condition and trend of the resource at the compensatory mitigation site; and
   b. The amount of change to the baseline condition and trend due to the compensatory mitigation measures and how that change will provide a benefit to the desired condition and trend of the resource.
4. Consider the risk of mitigation ineffectiveness.
5. Consider timeliness of mitigation measures.
6. Consider the use of mitigation banks, mitigation exchanges, and mitigation funds.

## G. Draft Compensatory Mitigation Measures, Mechanisms, and Site Lists

The BLM will consult with the Implementation Group (IG[2], which is comprised of State of Wyoming agencies; and county and local governments within Sweetwater and Carbon Counties, see Section 3 of the ROD) and work with industry to identify potential mitigation and compensatory mitigation sites and projects when compensatory mitigation is required. The BLM will encourage the continued involvement of all stakeholders in order to help inform the siting of compensatory mitigation measures, in coordination with the IG.

The BLM, in coordination with the aforementioned, will create, maintain, and update a list of suitable mitigation mechanisms that could be proposed and implemented as compensatory mitigation when residual impacts that warrant compensatory mitigation are identified for pronghorn, mule deer, and/or Greater Sage-Grouse as a result of development in the CD-C project area. The following will be considered when determining appropriateness of compensatory mitigation sites/mechanisms:

- Each compensatory mitigation site will need to be considered with respect to achieving the maximum benefit, toward the mitigation standard, to the resource impacted by the CD-C development and additionality, durability, landowner agreements, timeliness, risk, and administrative costs.
- Sites should be determined without preference to land ownership. If sited on BLM-managed lands, the BLM should consider other potential uses of that land that are compatible with the use of the site for compensatory mitigation. If sited on non-BLM-managed lands, there must be a formal and binding agreement with a willing land owner.

[2] For Greater Sage-Grouse compensatory mitigation, the State of Wyoming's compensatory mitigation oversight team may be represented on the IG.

- To increase efficiency, one compensatory mitigation site can provide opportunities for compensatory mitigation measures that benefit multiple resources that have been impacted by a single land use activity. In some cases, a single compensatory mitigation measure can benefit multiple resources that have been impacted by a single land use activity.

Compensatory mitigation mechanisms that the BLM considers appropriate include, but are not limited to, the following:

- Mitigation banks;
- Mitigation exchanges;
- Mitigation funds; and
- Authorized land user (i.e. proponent)-responsible compensatory mitigation measures.

The BLM, with input from the IG, will ensure that each compensatory mitigation mechanism used to meet a compensatory mitigation obligation is held to equivalent and effective standards, consistent with the Wyoming Conservation Bank Review Team (CBRT; comprised of representatives of state and federal agencies). In order to be considered, at a minimum each compensatory mitigation mechanism's sponsor should:

1. Establish and describe clearly-defined and measurable outcomes and performance standards for the compensatory mitigation measures, including the types and amounts of resources that will be restored, established, enhanced, and/or preserved, and describe how these outcomes will contribute to achieving established resources objectives and addressing landscape-scale needs.
2. Describe the factors considered during the site selection process, including how the sites will address landscape-scale needs.
3. Ensure and describe how the durability of the compensatory mitigation measures and sites will be maintained.
4. Assess and document the baseline conditions of the compensatory mitigation sites, with consideration to the conditions and trends of resources at all relevant scales.
5. Implement a robust monitoring program, which considers the conditions and trends of resources at all relevant scales, to assess the effectiveness of compensatory mitigation measures and identify any need for adaptive management to achieve the required mitigation outcomes.
6. Develop and implement a plan for compensatory mitigation measure(s) and site(s) that describes:
    a. Specifications for implementing the compensatory mitigation measures.
    b. The schedule and plan to maintain compensatory mitigation measures for the duration of the impacts.
    c. The triggers for adapting management, if necessary, to achieve the required outcomes of the compensatory mitigation measures.
    d. The accounting, tracking and reporting of measures/funds/credits.
7. Obtain financial assurances, as appropriate, to guarantee the implementation and effectiveness of compensatory mitigation measures and cover administration, durability, monitoring and reporting.

Following site-specific NEPA analysis that determines the need for compensatory mitigation, the BLM, in the decision document and land use authorization, will make the final determinations regarding the amount of compensatory mitigation, the types of compensatory mitigation measures selected, and the compensatory mitigation sites chosen. The BLM will need to verify that any credits provided by mitigation banks, exchanges, in-lieu fee fund programs, or proponent-responsible projects used to offset impacts are appropriate to address those impacts and meet the mitigation standard(s). The BLM will

participate in reviewing crediting methodologies developed by the sponsors of the compensatory mitigation mechanisms and/or other experts to help make this determination.

The following are examples of types of compensatory mitigation measures and mechanisms:

- **Mule Deer and Pronghorn Antelope and Associated Habitats:**

  There are several projects that can be implemented to improve habitat and use for big game species which include, but are not limited to: (1) sagebrush fertilization projects which help offset direct and indirect habitat losses by increasing sagebrush production, enhancing available winter forage and potentially increasing palatability and nutrient quality for wintering big game (specifically mule deer) (BLM 2012, BLM 2008c); (2) implement chemical thinning treatments (tebuthiuron, or Spike™) to increase forage variety, quantity and quality and improve the big sagebrush and mountain shrub age-class structure; (3) establish conservation easements on public or private land in high-quality habitat; (4) implement fence modification projects; (5) implement prescribed fire treatments for big game species (e.g., spring and fall ranges should focus on herbaceous component to help does with fawning and winter ranges should focus more on shrubs and shrub productivity); (6) seeding after fires; (7) mechanical treatments such as crushing with an aerator and including seeding in the treatment; (8) chaining, disking and imprinting pipe harrowing and aerating; (9) mowing; (10) other vegetation treatments such as planting of shrubs and aspen; and (11) control of invasive weeds (BLM 2012).

- **Greater Sage-Grouse:**

  There are several projects that can be implemented to improve habitat and use for Greater Sage-Grouse which include, but are not limited to:

  1. Fence Marking and Removal

     Christiansen (2009) estimated a 70-percent reduction in fence collision mortalities of Sage-Grouse could be expected along marked sections of fence. Stevens (2011) similarly predicted that marking fences with vinyl reflectors (flight diverters) reduced collision rates by up to 74 percent. To eliminate the threat of collisions, fences could be removed or marked with flight diverters similar to those used in the Christiansen (2009), Wolfe (2009), and Stevens (2011) studies to increase fence visibility to greater Sage-Grouse. Fences should be removed where possible, in consultation with and with concurrence of the grazing permittee. Where removal is not possible, two flight diverters should be installed between each fence span (4 m post-to-post). Priority areas for fence removal and marking should be: Sections of fence known to cause Sage-Grouse collisions; fences within 2 km (1.2 mi) of leks (Braun 2006; Stevens 2012) or other high risk areas; fences in areas with low slope and terrain ruggedness (Stevens 2012); and fence segments bounded by steel t-posts with spans greater than 4 m (Stevens 2012).

  2. Sagebrush Restoration and Enhancement

     Sagebrush restoration and enhancement creates new habitat for Sage-Grouse and can be used to create corridors between existing sagebrush patches to produce larger areas of contiguous habitat. Habitat for Sage-Grouse consists of a mosaic of plant communities dominated by sagebrush and a diverse grass and forb understory across the landscape (WGFD 2003). This mitigation measure increases the quality and quantity of habitat within the landscape, contributing to the long-term survival and success of the Greater Sage-Grouse.

     Sage-Grouse habitat would be restored by re-establishing sagebrush and understory grasses and forbs in disturbed areas (e.g., roads, unreclaimed and abandoned pipeline corridors, unreclaimed and abandoned well pads, burned areas, etc.). Treatment for mitigation credit is not planned for areas of Project disturbance, which will be restored as described in the plan of development, but in areas of high value and with durability that is commensurate with the life of the impact of the authorized project. Sagebrush can be seeded, planted as seedlings, or transplanted (i.e.,

containerized stems). Because seeded sagebrush takes a long time to grow to a size that provides habitat for Sage-Grouse, planting containerized stems is the most economical option. Sagebrush restoration and enhancement projects should include understory (grass and forb) treatments. Where possible, projects will be placed strategically to decrease habitat fragmentation by connecting existing occupied habitats.

3. Juniper Removal

   Fire suppression and other post-settlement conditions have allowed western juniper to spread into areas previously dominated by grasses, forbs, and shrubs. Miller et al. (2005) reports that many areas have experienced an estimated 10-fold increase in juniper over the last 130 years. The expansion of juniper and other conifer species reduces habitat for Sage-Grouse and other sagebrush obligate species that depend on large patches of sagebrush-dominated vegetation. Sagebrush cover decreases with juniper encroachment as the vegetation transitions into woodland.

   Most juniper communities are still in a state of transition. Miller et al. (2005) characterized three stages of woodland succession: Phase I (early) – trees are present but shrubs and herbs are the dominant vegetation that influence ecological processes (hydrologic, nutrient, and energy cycles) on the site; Phase II (mid) – trees are co-dominant with shrubs and herbs and all three vegetation layers influence ecological processes on the site; Phase III (late) – trees are the dominant vegetation and the primary plant layer influencing ecological processes on the site. Sites in Phase I or II successional stages often retain a significant understory of sagebrush (i.e., grasses and forbs), so removal of Phase I or II can produce immediate habitat effects for Sage-Grouse (NRCS 2010; USFWS recommendations).

   Juniper/conifer removal projects used for mitigation should focus primarily on the early successive stages of conifer/juniper stands (i.e., Phase I or Phase II juniper) with no cheatgrass component. Removal of juniper/conifer should be done by mechanical means without the use of fire or chemicals. Phase I juniper/conifer should be treated by having a field crew walk from tree-to-tree, cutting them into pieces and scattering them on-site (lop and scatter).

   Phase II juniper/conifer should be treated by using a masticator, a large mechanical device that goes from tree-to-tree and demolishes the tree with whirling blades; debris is then left on site (mastication). All juniper/conifer removal projects should include understory treatment, where needed, and vegetation monitoring until the understory vegetation is established.

4. Seeding of a Forb and Bunchgrass Understory

   Bunchgrasses are recognized as an important component of Sage-Grouse nesting and brood-rearing habitats (Connelly et al. 2000; Crawford et al. 2004). The structure and abundance of bunchgrasses influence the quality of a sagebrush/bunchgrass community site for nesting Sage-Grouse. Tall, dense, residual grass in nesting habitat improves hatching success by providing cover for incubating females (Cagney et al. 2009). Herbaceous cover may provide scent, visual, and physical barriers to potential predators (DeLong et al. 1995, as cited in Connelly et al. 2000). In addition to providing cover from predators, forbs are an important food source for Sage-Grouse broods. Sage-Grouse nesting and brood-rearing habitat is improved by seeding native bunchgrasses and forbs into existing sagebrush stands or into adjacent disturbance, increasing nest and brood success.

5. Purchase of Conservation Easements

   Conservation easements may be purchased and managed to remove the threats of specific land uses to Sage-Grouse. The purchase of easements can prevent future Sage-Grouse habitat destruction or degradation near urban areas or from oil and gas development. With appropriate

management, conservation easements can reduce fragmentation in species core areas and key habitats. Conservation easements purchased for mitigation will be used in a strategic way with a focus on areas/locations of highest demonstrable need leading to a reduction in habitat fragmentation.

## H. Credits, Durability, and Monitoring of Mitigation

The BLM does not intend to serve as a crediting agency. The Conservation Bank Review Team, an interagency group of Federal, State, Tribal, and/or local regulatory and resource agency representatives, oversees the establishment, use, and operation of a conservation bank, and the value of the credits therein. This group or a similar entity would validate credits from various banks or exchange systems, proponent sponsored projects, or other types of credits. The BLM does not propose to dictate to the operators how debits should be offset, but will analyze the equivalency between debits and credits prior to approving an action. The BLM will analyze that the credits are commensurate and appropriate to the debits.

The residual impacts that warrant compensatory mitigation, appropriate compensatory mitigation measures, and the process to determine the amount of compensatory mitigation are identified in **Section F**. During future NEPA analyses for actions that tier to the CD-C FEIS, additional consideration will be given to compensation to address timeliness, risk of compensatory mitigation failure, implementation and effectiveness monitoring, and administrative costs, as necessary.

The NEPA analysis, decision document, and land use authorization (via stipulations, conditions of approval, and/or terms and conditions attached to authorizations or permits) for actions that tier to the CD-C FEIS will clearly describe the compensatory mitigation obligations, as determined by following the framework provided by this Attachment. These obligations will include the actual compensatory mitigation measures and sites and associated outcomes. Effectiveness monitoring reports would be generated by the responsible party, in coordination with the Rawlins Field Office and submitted to the CD-C IG for review.

The responsible party requesting the land use authorization, will be required to acquire credits or fund mitigation measures that adequately achieve the compensatory mitigation obligation's outcomes identified in the land use authorization.

All compensatory mitigation measures and sites must be durable for the duration of the impact of the project, and additional (demonstrably new and would not have occurred without the compensatory mitigation measure).

For actions that tier to the CD-C FEIS, the Authorized Officer will retain discretion to require additional mitigation measures, beyond those described in this FEIS, as appropriate.

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## Glossary

For additional descriptions of terminology used in the CD-C FEIS, please see Chapter 8 of the Final EIS.

**Additionality**: a compensatory mitigation measure that improves the baseline conditions of the impacted resource, and is demonstrably new and would not have occurred without the compensatory mitigation measure.

**Application for Permit to Drill (APD)**: official request submitted by a lessee or operator to the BLM for permission to drill a well. The approved APD is a contract between the operator and the Federal Government and cannot be changed or modified unless authorized by the BLM.

**Baseline**: the pre-existing condition of a resource, at all relevant scales, which can be quantified by an appropriate attribute(s). During environmental reviews, the baseline is considered the affected environment that exists absent the project's implementation, and is used to compare predictions of the effects of the proposed action or a reasonable range of alternatives.

**Best management practices (BMPs)**: state-of-the-art, efficient, appropriate, and practicable mitigation measures for avoiding, minimizing, rectifying, and reducing or eliminating impacts over time.

**Change agents**: an environmental phenomena or human activity that can alter or influence the future condition and/or trend of a resource. Some change agents (e.g., roads) are the result of direct human actions or influence; others (e.g., climate change, wildland fire, and invasive species) may involve natural phenomena or be partially or indirectly related to human activities.

**Commensurate**: compensatory mitigation measures that are logically related and proportional to a land use activity's reasonably foreseeable impacts.

**Compensation**: compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20(e)).

**Compensatory mitigation measure**: an action that results in the restoration, establishment, enhancement, and/or preservation of resources in order to offset a residual effect.

**Compensatory mitigation mechanism**: a type of an arrangement where resources are restored, established, enhanced, and/or preserved (i.e. accrual of credits) for the purpose of compensating for residual effects to resources from land use activities (i.e. accrual of debits), and includes mitigation banks, mitigation exchanges, mitigation funds (also known as in-lieu fee programs), and authorized land user-responsible compensatory mitigation measures.

**Conditions of approval (COA)**: conditions or provisions (requirements) under which a site-specific surface disturbing or human presence activity (Application for Permit to Drill, sundry notice, right-of-way, etc.) is approved.

**Core Area**: Executive Order 2008-2, which was superseded by Executive Order 2010-4 and again by 2011-5, issued by the Governor of Wyoming, delineated a Core Area to protect populations of greater Sage-Grouse in the state. The Order also outlines restrictions on the density of future development and other human activities that limit impacts to greater Sage-Grouse populations.

**Crucial habitat**: any particular range or habitat component (often winter or winter/year-long range in Wyoming) that is the determining factor in a population's ability to maintain and reproduce itself at a certain level (theoretically at or above the Wyoming Game and Fish Department's population objective) over the long term.

**Crucial winter range**: the portion of the winter range to which a wildlife species is confined during periods of heaviest snow cover.

**Disruptive Activities**: This term/phrase refers to those public land resource uses/activities that are likely to alter the behavior of, displace, or cause excessive stress to animal or human populations. This

term/phrase does not apply to any physical disturbance of the features of the land surface. Examples of disruptive activities may include, among others: noise, human foot or vehicle traffic, or other human presence, regardless of the purpose of the activity. When administered as a land use restriction (e.g., No Disruptive Activities), or provision, this phrase prohibits or limits the physical presence of sound above ambient levels, lights, and the nearness of people and their activities. As a case in point, this restriction is often aimed at protecting wildlife during critical life stages, or during periods of severe winter weather conditions, although it could apply to any resource value on the public lands. Disruptive activities include both short- and long-term effects on species.

**Durability**: the maintenance of the effectiveness of a mitigation measure and/or a compensatory mitigation site, including resource, administrative, and financial considerations.

**Duration of the impact**: the time it takes to restore the resources impacted (including direct and indirect effects) by a land use activity, even if this time period extends beyond the expiration of the land use activity. The duration of some impacts may be perpetuity.

**Fugitive Dust**: airborne emissions of visible and nonvisible fine, dry particulate matter smaller than 100 micrometers (microns) that result from surface disturbance activities.

**Habitat function**: arrangement of habitat features and the capability of those features to sustain species, populations, and diversity of wildlife over time (WGFD 2010a).

**Invasive species**: A species that is not native (or is alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

**Landscape**: a geographic area encompassing an interacting mosaic of ecosystems and human systems that is characterized by a set of common management concerns. The landscape is not defined by the size of the area, but rather by the interacting elements that are relevant and meaningful in a management context.

**Mitigation**: includes, avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and, compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

**Mitigation standard**: a component of a land use plan's resource objective that describes the extent to which mitigation will be applied (e.g. net gain, no net loss, net loss).

**Minimization**: minimizing impacts by limiting the degree or magnitude of the action and its implementation (40 CFR 1508.20(b)).

**Net gain**: when mitigation results in an improvement above baseline conditions.

**Net loss**: when the lack of mitigation results in a negative change to baseline conditions.

**No net loss**: when mitigation results in no negative change to baseline conditions (e.g. fully offset or balanced).

**Rectification**: rectifying the impact by repairing, rehabilitating, or restoring the affected environment (40 CFR 1508.20[c]).

**Residual effects**: any adverse foreseeable effect that are expected to remain after consideration of the first four steps in the mitigation hierarchy; also referred to as unavoidable impacts. The implementation of mitigation measures (e.g. rectification) at some point in the distant future does not eliminate a residual effect that will exist until that mitigation measure's outcome is achieved.

**Significant Impact**: effects of sufficient context and intensity that an environmental impact statement is required. The CEQ regulations at 40 CFR 1508.27(b) include ten considerations for evaluating intensity.

**Special status species (SSS)**: Includes proposed species, listed species, and candidate species under the ESA; state-listed species; and BLM State-Director-designated sensitive species (BLM Manual 6840—Special Status Species Policy).

**Surface-disturbing activities**: Any cation created through mechanized or mechanical means that would cause soil mixing or result in alteration or removal of soil or vegetation and expose the mineral soil to erosive processes. Used in the literal context of actual, physical disturbance and movement or removal of the land surface and vegetation. Examples of surface disturbance include construction of well pads, pits, reservoirs, pipelines, and facilities (e.g. parking lot and tanks).

**Timeliness**: the lack of a time lag between the impact to the resources and the achievement of the outcomes of the associated mitigation measures.

## Appendix 1. Generic Debit Formula Example:

There are various methods of calculating compensatory mitigation credits and debits when residual impacts that warrant compensatory mitigation are identified during the site-specific NEPA analysis. The preferred method of calculating compensatory mitigation credits and debits is the use of formulas. The use of formulas helps the BLM to ensure that mitigation standards as identified above are achieved, and that the identified compensatory mitigation would be commensurate with the residual impacts identified in the site-specific NEPA analysis. One formula that the BLM could use to determine the appropriate amount of compensatory mitigation is included in this document, below.

Another example formula is from the State of Wyoming's Greater Sage-Grouse Compensatory Mitigation Framework. The State of Wyoming has approved and adopted a Greater Sage-Grouse compensatory mitigation framework as referenced in Executive Order 2015-4. Still other approaches to the calculation of compensatory mitigation may be appropriate; the BLM will determine the appropriate approach for this project in consultation with the project proponent, the State of Wyoming, and other cooperators.

In the following example, spatial multipliers appropriate for each impact would vary based on the habitat characteristics determined at the site-specific level; the examples shown below use arbitrarily assigned values.

In determining how many debits are assigned to a particular residual impact, the **area** of residual effects (i.e. acres of direct and indirect impacts) is considered the *base* compensatory mitigation obligation. The base obligation (i.e. area) is then adjusted based on the **quality** of the resource being impacted (i.e. the suitable or unsuitable[3]) and the **spatial characteristics** of the resources (i.e. critical nesting habitat or rarely used habitat):

$$\{[a+a(y_1)+a(y_2)+a(y_3)+\ldots]q\}x = \text{debits}$$

Where:

a = area (e.g. acres of direct and indirect impact)

*Direct impacts are represented by the footprint of the project. A sigmoidal decay curve is used to determine indirect impacts from, and in addition to, the project footprint* (Nevada Habitat Quantification Tool Scientific Methods Document 2014)*(applying the curve based on the specifics of the proposed project piece and the resource being impacted)*

y = spatial characteristics (e.g. critical nesting habitat or scarcely utilized habitat)

*Relevant and important spatial characteristics of the resources within the resources' landscape are identified by scientists and the agencies responsible for managing those resources. The spatial characteristics are weighted based on the importance of these spatial characteristics and serve as multipliers.*

[3] This refers to unsuitable habitat as used by the 2011 Governor's Executive Order and is not intended to address habitat quality; rather, "unsuitable" habitat may be an existing disturbance within priority habitat. When successfully reclaimed, the currently unsuitable habitat will once again become suitable habitat. The identification of unsuitable habitat within generally suitable habitat should incentivize proponents to co-locate projects to avoid creating additional disturbance.

q = quality (e.g. suitable or unsuitable)

*The quality of resource is determined by scientists and the agencies responsible for managing those resources. The quality is weighted based on the importance of that resource and serves as a multiplier.*

x = other

*Application of the generic debit formula to mule deer and pronghorn crucial winter range when the site-specific NEPA analysis has identified that residual effects that warrant compensatory mitigation are anticipated:*

$$\{[a(y_\chi d_\chi)+a(y_\chi d_\chi)+a(y_\chi d_\chi)+\ldots]qt\} = \text{debits}$$

*Where:*

a = area (e.g. acres of direct and indirect impact)

y = spatial multipliers representing a range of important habitats (spatial characteristics) (WGFD 2010a)

y = 2 if mapped High Use Migration Corridors

y = 3 if mapped Stop Over Spots within High Use Migration Corridors

y = 3 if mapped Crucial Winter Range

$d^a$ = current density of development for pronghorn antelope

Current density can be determined through GIS analysis of well location per square mile (thresholds below are described in WGFD's Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats) (WGFD 2010a).

$d^a$ = 2 if disturbance density over 1/640, but under 4/640 and/or under 3%

$d^a$ = 4 if disturbance density over 5/640, but under 16/640 and/or over 3%, but under 12%

$d^a$ = 8 if disturbance density over 16/640 and/or over 12%

$d^m$ = current density of development for mule deer

Current density can be determined through GIS analysis of well location per square mile (thresholds below are described in WGFD's Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats) (WGFD 2010a).

$d^m$ = 2 if disturbance density over 1/640, but under 2/640 and/or under 3%

$d^m$ = 4 if disturbance density over 2/640, but under 4/640 and/or over 3%, but under 9%

$d^m$ = 8 if disturbance density over 4/640 and/or over 9%,

q = quality (determination of general habitat condition)

q = 1 in suitable mule deer and/or pronghorn antelope habitat

q = 0.75 in unsuitable mule deer and/or pronghorn antelope habitat

The full debit is assessed in suitable habitat and "discounted" if in unsuitable / disturbed locations (i.e. co-located with another disturbance).

t = temporal scale of the impact (replaces "x" in the generic formula)

t = 1 if the impact is temporary (< 1 year);

t = 2 if the impact is permanent.

*Application of the generic debit formula to Greater Sage-Grouse when the site-specific NEPA analysis has identified residual effects that warrant compensatory mitigation are anticipated:*

$$\{[a+a(y_\chi)+a(y_\chi)+a(y_\chi)+a(y_\chi)]q\}s = \text{debits}$$

*Where:*

a = area (acres of direct and indirect impact)

y = spatial multipliers representing a range of habitat characteristics (WGFD 2010a):

$y_2$ = 2 if exceeding density or disturbance thresholds within PHMA;

$y_3$ = 4 if inside of PHMA and within 4 miles of a lek

4 miles surrounding a lek – the distance at which impacts to a single lek remain discernable (used as the distance for the DDCT analysis) (Holloran and Anderson 2005, Holloran et al. 2007)

$y_4$ = 8 if within PHMA and exceeding density or disturbance thresholds, within 4 miles, and within 0.6 mile of a lek.

0.6 miles surrounding a lek – the distance in which more than 90 percent of breeding season movements by male grouse are found (Carr 1967, Wallestad and Schladweiler 1974, Rothenmaier 1979, Emmons 1980, Schoenberg 1982)

$y_5$ = 8 if within GHMA and within 0.25 mile of a lek

0.25 miles surrounding a lek outside of PHMA – half the distance in which more than 90 percent of breeding season movements by male grouse are found (Carr 1967, Wallestad and Schladweiler 1974, Rothenmaier 1979, Emmons 1980, Schoenberg 1982)

q = quality (determination of general habitat condition).

q = 1 in suitable Greater Sage-Grouse habitat

q = 0.75 in "unsuitable" Greater Sage-Grouse habitat

The full debit is assessed in suitable habitat and "discounted" if in unsuitable (please see earlier definition) or disturbed locations (Wyoming Executive Order 2011-5, Appendix I).

s = surface (above ground or below ground infrastructure).

s = 1 for above ground infrastructure

s = 0.5 for below ground infrastructure

The full debit is assessed for surface and/or tall structures and a "discount" is provided for buried infrastructure.

The multipliers presented in this example are not static and may be subject to change based on site-specific issues, advances in knowledge within the scientific community, or other factors.

*Greater Sage-Grouse example:*

- Project Description

The proposed project is a well pad, pipeline, power line, and road. The proposed well pad will have two wells, Well #1 and Well #2, and disturb approximately 1.5 acres. The two-track would be upgraded to access the well locations from the southeast. The access to the proposed well would upgrade an existing two-track and will directly disturb approximately 2.5 acres (outside of 0.6 mile of Plant lek). Power lines would be buried with the flow line using a spider drill, following an existing road, but will still disturb approximately 2 acres (0.29 acres within 0.6 mile of Plant lek and 1.7 acres outside of 0.6 mile of Plant lek). The development phase would have a timing limitation condition of approval to restrict construction to outside the nesting season. Construction on the proposed project is due to begin August 1, 2015 and be completed by November 30 of the same year. The expected life of the wells is 30 years. A Density and Disturbance Calculation Tool (DDCT) analysis was completed and the proposed disturbance is located in a DDCT analysis area that is was already disturbed at approximately 15 percent and has an energy development density of greater than 6.5/640. This project further exceeds the 5 percent disturbance and greater than 1 energy location per 640 acres cap.

Residual impacts remain because the new project proposal is inside PHMA and the density of disturbance of an energy or mining facility would be over an average of one site per square mile (640 acres) within the DDCT. The calculation is applied to the energy facility (the well location).

- Calculation for well disturbance:

  Well disturbance: a = 1.5 acres

  The well is within PHMA and exceeds the density thresholds. Therefore, $y_1 = 0$, $y_5 = 0$, and $y_2 = 2$.

  The well is within PHMA and within 4 miles of a lek. Therefore, $y_3 = 4$.

  The well is within PHMA, within 4 miles, but not within 0.6 mile of a lek. Therefore, $y_4 = 0$.

  The well is within unsuitable (disturbed) habitat. Therefore, q = 0.75.

  The well infrastructure is above ground. Therefore, s = 1.

  {[1.5(2)+1.5(4)]0.75}1 = 6.5 debits

  Residual impacts remain because the project is inside PHMA, exceeds the density and disturbance thresholds, and is within 4 miles of a lek. The calculation is applied to all components of the project, split out as proposed within each habitat characteristic.

- Calculation for access road impacts

  There will be 2.5 directly impacted acres and 160.98 indirectly impacted acres, for a total of 163.48 acres impacted outside 0.6 mile of the lek. Therefore, a = 163.48

  The access road is within PHMA. Therefore, $y_1 = 0$, $y_5 = 0$, and $y_2 = 2$.

  The access road is within PHMA, within 4 miles of a lek. Therefore, $y_3 = 4$.

  The access road is within unsuitable (disturbed) habitat. Therefore, q = 0.75.

  The access road is above ground. Therefore, s = 1.

  {[163.48 (2)+163.48(4)]0.75}1 = 735.66 debits

- Calculation for pipeline / power line

  There will be 1.7 directly impacted acres outside 0.6 mile of the lek. Therefore, a = 1.7.

The pipeline / power line is within PHMA. Therefore, $y_1 = 0$, $y_5 = 0$, and $y_2 = 2$

The pipeline / power line is within PHMA and within 4 miles of a lek. Therefore, $y_3 = 4$.

The pipeline / power line is within PHMA, within 4 miles, and 0.29 directly impacted acres inside 0.6 mile of the lek. Therefore, for this portion of the access road, a = 0.29 and $y_4 = 8$.

The pipeline / power line is within unsuitable (disturbed) habitat. Therefore, q = 0.75.

The pipeline / power line is below ground. Therefore, s = 0.5.

{[1.7(2)+1.7(4)+0.29(8)]0.75}0.5 = 12.80 debits

- Total debits from the entire project as submitted: 754.96 debits.

## Appendix 2. Sigmoidal Decay Curve Function as explained in the Nevada Habitat Quantification Tool Scientific Methods Document (2014).

Indirect effects can be calculated by applying distance-decay curves to habitat around disturbances. The indirect effect relationship is established by a curve with the y-intercept the weight and the x-intercept the distance. Current literature, while inconclusive on the magnitude of indirect effects, does conclude that there is a significant effect near the source, and the effect fades as distance from the source increases.

A sigmoidal decay curve estimates the distance from anthropogenic features at which the indirect impact dissipates. Anthropogenic features believed to represent the greatest degree of impact should use a decay curve modifier of 100, representing 100% disturbance (impacted to a degree in which no value will be provided to the resource). All other, lesser, disturbances are assigned a relative weight (eg. 100% for a primary, haul, road, 50% for a secondary, less traveled, road). The actual extent, or footprint, of a feature is assigned the appropriate weight value for that feature type. For anthropogenic features that have specified distance effects, the weighted value decreases from the location of the feature out until it reaches zero at that distance. This distance decay and is applied as a sigmoid curve, using the following sigmoid function:

$$y = \frac{1}{1 + e\ (b\left(\frac{x}{c} - a\right))} w$$

where:

a –shifts curve to the left,

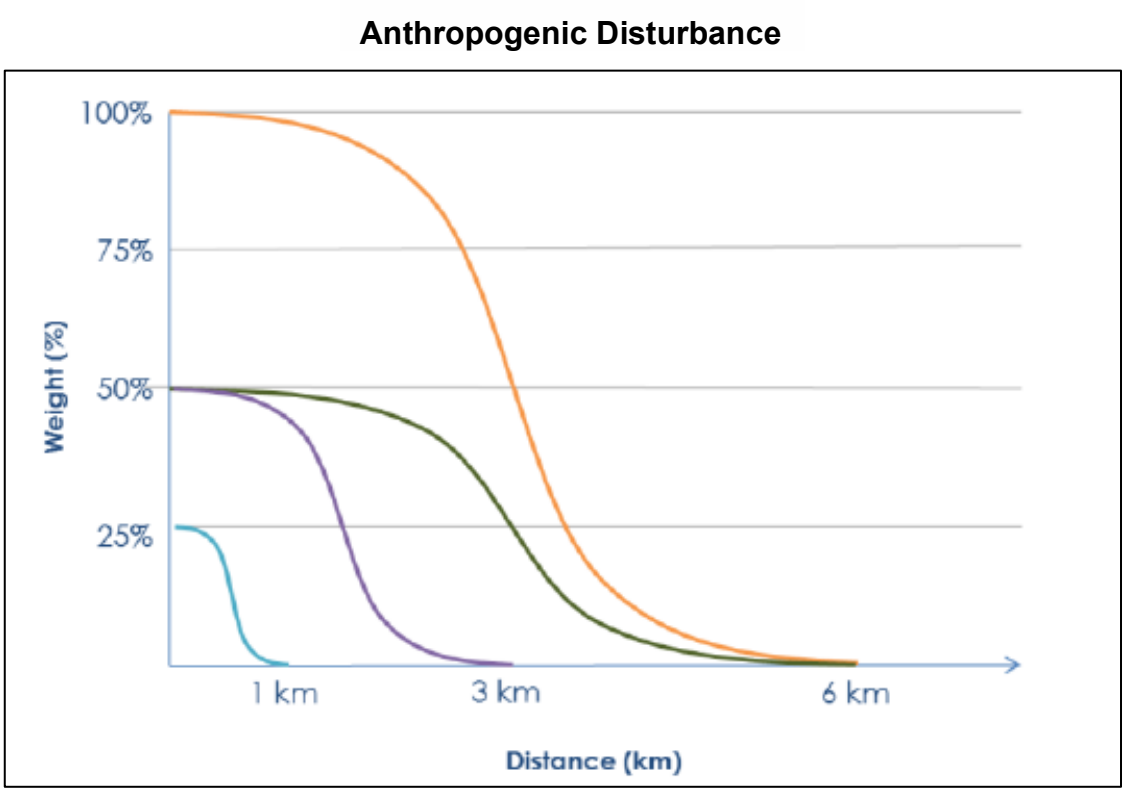
b –determines spread of curve, or slope of rapidly decreasing part of curve,

c - scalar to adjust total distance of interest,

x –distance in meters from impact,

w –weight of impact (maximum value at 0 distance).

From a GIS standpoint, it is possible to use a multiple-step process in to calculate the indirect acres. First, a grid is created (for example, using 10m) that has a value for the minimum distance to the feature (in meters). This calculates the distance on a continuous basis. Once the distance is obtained, it is possible to run the sigmoidal decay curve equation for each cell of the grid, where the value for x will be the value of the cell. Other inputs would be the total distance in meters, that would be considered to have an indirect effect, which allows for c to be calculated and the weight 0-1 of the indirect effect at distance 0. This provides a percent of that cell would be indirectly effected, and all the cells in the area of interest can be added up and converted to acres (N. Graf, personal communication, July 13, 2016).




Example distance-decay curves with the y-intercept the weight and the x-intercept the distance associated with the anthropogenic disturbances.

Source: Nevada Habitat Quantification Tool Scientific Methods Document 2014.